

In re Patent Application of:
CAIN ET AL.
Serial No. 10/658,360
Filing Date: **SEPTEMBER 9, 2003**

In the Claims:

1. (Original) A mobile ad hoc network (MANET) comprising:

a plurality of mobile nodes each comprising a wireless communications device and a controller connected thereto;

said controller operating in accordance with a multi-layer protocol hierarchy for,

at an upper protocol layer, establishing a quality-of-service (QoS) threshold;

at at least one intermediate protocol layer below the upper protocol layer, selecting at least one route for transmitting data to at least one destination mobile node based upon the QoS threshold, and determining whether a QoS metric for the selected route falls below the QoS threshold; and

at a lower protocol layer below the at least one intermediate protocol layer, cooperating with said wireless communications device to

determine the QoS metric for the at least one selected route,

transmit data to the at least one destination mobile node via the at least one selected route, and

adjust signal transmission power based upon a determination that the QoS metric has fallen below the QoS threshold.

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2. (Original) The MANET of Claim 1 wherein, at the lower protocol layer, said controller also cooperates with said wireless communications device to adjust signal transmission gain in a desired direction based upon a determination that the QoS metric has fallen below the QoS threshold.

3. (Original) The MANET of Claim 1 wherein said wireless communications device provides an adjustable signal transmission pattern; and wherein, at the lower protocol layer, said controller also cooperates with said wireless communications device to adjust the signal transmission pattern based upon a determination that the QoS metric has fallen below the QoS threshold.

4. (Original) The MANET of Claim 1 wherein, at the at least one intermediate protocol layer, said controller encodes data prior to transmission; and wherein said controller also adjusts an amount of error correction coding based upon a determination that the QoS metric has fallen below the QoS threshold.

5. (Original) The MANET of Claim 1 wherein, at the lower protocol layer, said controller cooperates with said wireless communications device to modulate the data using a first modulation technique if the QoS metric is greater than or equal to the QoS threshold, and otherwise using a second modulation

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technique.

6. (Original) The MANET of Claim 1 wherein, at the lower protocol layer, said controller cooperates with said wireless communications device to transmit data at a data rate; and wherein said controller also cooperates with said wireless communications device to adjust the data rate based upon a determination that the QoS metric has fallen below the QoS threshold.

7. (Original) The MANET of Claim 1 wherein the upper protocol layer comprises an application layer.

8. (Original) The MANET of Claim 1 wherein the at least one intermediate protocol layer comprises at least one of a session layer, a transport layer, a network layer, and a radio transport layer.

9. (Original) The MANET of Claim 1 wherein the lower protocol layer comprises a physical layer.

10. (Original) The MANET of Claim 1 wherein the QoS threshold is based upon at least one of available bandwidth, error rate, end-to-end delay, end-to-end delay variation, hop count, expected path durability, and priority.

11. (Original) A mobile ad hoc network (MANET)

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comprising:

a plurality of mobile nodes each comprising a wireless communications device and a controller connected thereto;

said controller operating in accordance with a multi-layer protocol hierarchy for,

at an upper protocol layer, establishing a quality-of-service (QoS) threshold;

at at least one intermediate protocol layer below the upper protocol layer, selecting at least one route for transmitting data to at least one destination mobile node based upon the QoS threshold, and determining whether a QoS metric for the selected route falls below the QoS threshold; and

at a lower protocol layer below the at least one intermediate protocol layer, cooperating with said wireless communications device to

determine the QoS metric for the at least one selected route,

transmit data to the at least one destination mobile node via the at least one selected route, and

adjust signal transmission gain in a desired direction based upon a determination that the QoS metric has fallen below the QoS threshold.

12. (Original) The MANET of Claim 11 wherein said wireless communications device provides an adjustable signal

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transmission pattern; and wherein, at the lower protocol layer, said controller also cooperates with said wireless communications device to adjust the signal transmission pattern based upon a determination that the QoS metric has fallen below the QoS threshold.

13. (Original) The MANET of Claim 11 wherein, at the at least one intermediate protocol layer, said controller encodes data prior to transmission; and wherein said controller also adjusts an amount of encoding based upon a determination that the QoS metric has fallen below the QoS threshold.

14. (Original) The MANET of Claim 11 wherein, at the lower protocol layer, said controller cooperates with said wireless communications device to modulate the data using a first modulation technique if the QoS metric is greater than or equal to the QoS threshold, and otherwise using a second modulation technique.

15. (Original) The MANET of Claim 11 wherein, at the lower protocol layer, said controller cooperates with said wireless communications device to transmit data at a data rate; and wherein said controller also cooperates with said wireless communications device to adjust the data rate based upon a determination that the QoS metric has fallen below the QoS threshold.

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16. (Original) The MANET of Claim 11 wherein the upper protocol layer comprises an application layer.

17. (Original) The MANET of Claim 11 wherein the at least one intermediate protocol layer comprises at least one of a session layer, a transport layer, a network layer, and a radio transport layer.

18. (Original) The MANET of Claim 11 wherein the lower protocol layer comprises a physical layer.

19. (Original) The MANET of Claim 11 wherein the QoS threshold is based upon at least one of available bandwidth, error rate, end-to-end delay, end-to-end delay variation, hop count, expected path durability, and priority.

20. (Original) A mobile ad hoc network (MANET) comprising:

a plurality of mobile nodes each comprising a wireless communications device and a controller connected thereto, said wireless communications device providing an adjustable signal transmission pattern, and said controller operating in accordance with a multi-layer protocol hierarchy for,

at an upper protocol layer, establishing a quality-of-service (QoS) threshold;

at at least one intermediate protocol layer below the upper protocol layer, selecting at least one route

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for transmitting data to at least one destination mobile node based upon the QoS threshold, and determining whether a QoS metric for the selected route falls below the QoS threshold; and

at a lower protocol layer below the at least one intermediate protocol layer, cooperating with said wireless communications device to

determine the QoS metric for the at least one selected route,

transmit data to the at least one destination mobile node via the at least one selected route, and

adjust the signal transmission pattern based upon a determination that the QoS metric has fallen below the QoS threshold.

21. (Original) The MANET of Claim 20 wherein, at the at least one intermediate protocol layer, said controller encodes data prior to transmission; and wherein said controller also adjusts an amount of encoding based upon a determination that the QoS metric has fallen below the QoS threshold.

22. (Original) The MANET of Claim 20 wherein, at the lower protocol layer, said controller cooperates with said wireless communications device to modulate the data using a first modulation technique if the QoS metric is greater than or equal to the QoS threshold, and otherwise using a second modulation

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technique.

23. (Original) The MANET of Claim 20 wherein, at the lower protocol layer, said controller cooperates with said wireless communications device to transmit data at a data rate; and wherein said controller also cooperates with said wireless communications device to adjust the data rate based upon a determination that the QoS metric has fallen below the QoS threshold.

24. (Original) The MANET of Claim 20 wherein the upper protocol layer comprises an application layer.

25. (Original) The MANET of Claim 20 wherein the at least one intermediate protocol layer comprises at least one of a session layer, a transport layer, a network layer, and a radio transport layer.

26. (Original) The MANET of Claim 20 wherein the lower protocol layer comprises a physical layer.

27. (Original) The MANET of Claim 20 wherein the QoS threshold is based upon at least one of available bandwidth, error rate, end-to-end delay, end-to-end delay variation, hop count, expected path durability, and priority.

28. (Original) A method for operating a mobile node in

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a mobile ad hoc network (MANET), comprising a plurality of mobile nodes, in accordance with a multi-layer protocol hierarchy, the mobile node comprising a wireless communications device, the method comprising:

- at an upper protocol layer, establishing a quality-of-service (QoS) threshold;

- at at least one intermediate protocol layer below the upper protocol layer, selecting at least one route for transmitting data to at least one destination mobile node based upon the QoS threshold, and determining whether a QoS metric for the selected route falls below the QoS threshold; and

- at a lower protocol layer below the at least one intermediate protocol layer,

- using the wireless communications device to determine the QoS metric for the at least one selected route,

- causing the wireless communications device to adjust signal transmission power based upon a determination that the QoS metric has fallen below the QoS threshold, and

- causing the wireless communications device to transmit data to the at least one destination mobile node via the at least one selected route.

29. (Original) The method of Claim 28 further comprising, at the lower protocol layer, causing the wireless communications device to also adjust signal transmission gain in

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a desired direction based upon a determination that the QoS metric has fallen below the QoS threshold.

30. (Original) The method of Claim 28 wherein the wireless communications device provides an adjustable signal transmission pattern; and further comprising, at the lower protocol layer, causing the wireless communications device to also adjust the signal transmission pattern based upon a determination that the QoS metric has fallen below the QoS threshold.

31. (Original) The method of Claim 28 further comprising, at the at least one intermediate protocol layer:
encoding data prior to transmission; and
adjusting an amount of encoding based upon a determination that the QoS metric has fallen below the QoS threshold.

32. (Original) The method of Claim 28 further comprising, at the lower protocol layer, causing the wireless communications device to modulate the data using a first modulation technique if the QoS metric is greater than or equal to the QoS threshold, and otherwise using a second modulation technique.

33. (Original) The method of Claim 28 wherein the wireless communications device transmits data at a data rate; and

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further comprising causing the wireless communications device to adjust the data rate at the lower protocol layer based upon a determination that the QoS metric has fallen below the QoS threshold.

34. (Original) A method for operating a mobile node in a mobile ad hoc network (MANET), comprising a plurality of mobile nodes, in accordance with a multi-layer protocol hierarchy, the mobile node comprising a wireless communications device, the method comprising:

- at an upper protocol layer, establishing a quality-of-service (QoS) threshold;

- at at least one intermediate protocol layer below the upper protocol layer, selecting at least one route for transmitting data to at least one destination mobile node based upon the QoS threshold, and determining whether a QoS metric for the selected route falls below the QoS threshold; and

- at a lower protocol layer below the at least one intermediate protocol layer,

- using the wireless communications device to determine the QoS metric for the at least one selected route,

- causing the wireless communications device to adjust signal transmission gain in a desired direction based upon a determination that the QoS metric has fallen below the QoS threshold, and

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causing the wireless communications device to transmit data to the at least one destination mobile node via the at least one selected route.

35. (Original) The method of Claim 34 wherein the wireless communications device provides an adjustable signal transmission pattern; and further comprising, at the lower protocol layer, causing the wireless communications device to also adjust the signal transmission pattern based upon a determination that the QoS metric has fallen below the QoS threshold.

36. (Original) The method of Claim 34 further comprising, at the at least one intermediate protocol layer: encoding data prior to transmission; and adjusting an amount of encoding based upon a determination that the QoS metric has fallen below the QoS threshold.

37. (Original) The method of Claim 34 further comprising, at the lower protocol layer, causing the wireless communications device to modulate the data using a first modulation technique if the QoS metric is greater than or equal to the QoS threshold, and otherwise using a second modulation technique.

38. (Original) The method of Claim 34 wherein the

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wireless communications device transmits data at a data rate; and further comprising causing the wireless communications device to adjust the data rate at the lower protocol layer based upon a determination that the QoS metric has fallen below the QoS threshold.

39. (Original) A method for operating a mobile node in a mobile ad hoc network (MANET), comprising a plurality of mobile nodes, in accordance with a multi-layer protocol hierarchy, the mobile node comprising a wireless communications device providing an adjustable signal transmission pattern, the method comprising:

- at an upper protocol layer, establishing a quality-of-service (QoS) threshold for data transmission;

- at at least one intermediate protocol layer below the upper protocol layer, selecting at least one route for transmitting data to at least one destination mobile node based upon the QoS threshold, and determining whether a QoS metric for the selected route falls below the QoS threshold; and

- at a lower protocol layer below the at least one intermediate protocol layer,

- using the wireless communications device to determine the QoS metric for the at least one selected route,

- causing the wireless communications device to adjust the signal transmission pattern based upon a determination that the QoS metric has fallen below the QoS threshold, and

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causing the wireless communications device to transmit data to the at least one destination mobile node via the at least one selected route.

40. (Original) The method of Claim 39 further comprising, at the at least one intermediate protocol layer: encoding data prior to transmission; and adjusting an amount of encoding based upon a determination that the QoS metric has fallen below the QoS threshold.

41. (Original) The method of Claim 39 further comprising, at the lower protocol layer, causing the wireless communications device to modulate the data using a first modulation technique if the QoS metric is greater than or equal to the QoS threshold, and otherwise using a second modulation technique.

42. (Original) The method of Claim 39 wherein the wireless communications device transmits data at a data rate; and further comprising causing the wireless communications device to adjust the data rate at the lower protocol layer based upon a determination that the QoS metric has fallen below the QoS threshold.